REMARKS

In response to the final Office Action mailed on March 27, 2003, Applicant wishes to enter the following remarks for the Examiner's consideration. Applicant has amended the specification and claims 6, 14, 27, 28, 31, and 37. Claims 1-17 and 27-43 are pending in the application, claims 18-26 are currently withdrawn.

Election/Restrictions

1. Species I (Fig. 1, claims 1-17 and 27-43) is provisionally elected with traverse. The restriction requirement is believed to be improper under 35 USC 121 because the species shown in Fig. 1 and Fig. 8 are not independent in structure, nor are they independent in operation. All of the elements of claim 1 are found in both Fig. 1 and Fig. 8, namely:

(a) a first optical fiber (102)

(b) a second optical fiber (110)

(c) an optical power detector or meter (116)

Similarly, the method of claim 34 describes the operation of the systems in both Fig. 1 and Fig. 8. An optical power meter and an optical power detector are equivalent descriptions for the element 116. Applicant therefore submits that both claim 1 and claim 34 are generic claims. Dependent claims 2, 4 and 5, for example, are also generic claims covering figures 1 and 8.

1 2 4 5 34

Drawings

3. The drawings have been objected to under 37 CFR 1.83(a). As discussed in above, claim 1 relates to both Fig. 1 and Fig. 8. Claim 3 depends from claim 1, and relates to Fig. 8. The mirror is depicted as element 802 in the exemplary system shown in Fig. 8.

Objection to Claim 31.

4. Claim 31 has been amended to replace "fiducial" with "fiduciary". The specification at page 14 line 4 has been similarly amended.

6. Rejection of claims under 35 USC §102

Claims 1-17 and 27-43 have been rejected under 35 USC §102(b) as being anticipated by Nguyen (Patent No. US 5,389,789). Applicant respectfully traverses this rejection of the claims. Nguyen describes a system in which a light sensor is used to detect whether a moving object has blocked the sensor. This provides information as to the *time* when the edge of the object passes the sensor. To determine the position of the edge of the object, Nguyen must use an array of sensors. If one sensor is obscured and the adjacent one is not, the edge is determined to be somewhere between the two sensors. A system of this type has a spatial resolution determined by the physical size of the sensors and the spacing of the sensors. In Nguyen's system this is on the order of 1/16". In contrast, the present invention measures the positioning of an edge to a sub-micron accuracy -- more than 1000 times better resolution. Additionally, this uses a *single* optical transmitter and receiver. This improved resolution is obtained by (1) using laser light -- which has a very narrow beam -- and (2) by positioning the edge within the light beam so that it partially obscures the sensor. The amount of light that is blocked is used to determine how much of the sensor is blocked and therefore the position of the edge. The resolution is a fraction of the diameter of the optical fiber sensor. Resolution is further enhanced by using optical fibers having very small diameters. Applicant submits that (1) and (2) are not taught by Nguyen.

Claim 1 has been rejected under 35 USC §102 as being anticipated by Nguyen (US 5,389,789). Applicant respectfully traverses this rejection. Nguyen discloses a device for measuring gaps or tears in paper in a paper machine and also for

detecting the edges of the paper. First, Nguyen does not teach the use of a laser light source and the optical fibers in Nguyen's device are not adapted to receive laser light. The examiner relies upon col. 4, lines 6-8 which described the use of IR (infra red) light in a specified band of wavelengths rather than laser light. Sensors of the type supplied by Scientific Technologies (col. 4, lines 41-47) use light emitting diodes (LEDs) as the light source. LEDs produce light in a narrow band, but this light is neither monochromatic nor coherent, so is not equivalent to laser light. Laser light produces a much narrower beam, which provides greater resolution. In addition, the diameter of the fibers is less than 1/16" or 1587 μm. Single mode optical fibers adapted to receive laser light have diameters more than 1000 times smaller. Nguyen use of fibers up to 1/16" teaches away from the use of fibers adapted for laser light. Further, in accordance with claim 1, an edge is detected when "the object at least partially obstructs the light beam". Nguyen detects the edge only when complete obstruction of the light beam has occurred, i.e. when the source is blocked (col. 3 lines 18-26). The use of partial obstruction, together with fibers adapted for use with laser light, allows much greater accuracy to be achieved. Nguyen's detector has a resolution of about 0.125" (3175 μm) (col. 5, lines 44-49), whereas the detector of the present invention has a resolution of less than 1 μm. The examiner relies upon col. 4 lines 1-6, which merely says that the light source (12) and receiver (14) are positioned one each side of the web (16) -- the method of detection of the edge 26 is not described.

Claim 2 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen discloses a light source (12) but does not teach, suggest, disclose or render obvious that this is a laser light source. The light is described as having wavelengths in the range 7.5-9 μm (col. 4 lines 8-10). This is consistent with the only example given by Nguyen (col. 4, lines 41-47) which uses an LED light source. Laser light is fundamentally different from

most other forms of light (including that generated by an LED) because it is coherent and monochromatic.

Claim 3 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen's Fig. 1 does not show a mirror. Applicant submits that Nguyen does not teach, suggest, disclose or render obvious the use of a mirror and does not teach the use of reflected light.

Claim 4 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen's Fig. 2 shows large diameter (up to 1/16") optical fibers 34. For a fiber to operate as a single mode fiber for light of a given wavelength, the diameter of the fiber must be of the same order or smaller than the wavelength of the light. Nguyen uses fibers of diameter up to 1/16" or 1587 μm (col. 4, lines 16-21) together with light with wavelengths in the range 7.5-9 μm (col. 4 lines 8-10). These fibers cannot act as single mode fibers. Furthermore, Nguyen does not teach, suggest, disclose or render obvious the use of single mode optical fibers.

Claim 5 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen (col. 4, line 8) teaches that the wavelength of the light in the range 7.5-9 μm. This dimension relates to the scale of variations in the light beam along the length of the beam, and is unrelated to the diameter of the light beam. In Nguyen's device the light beam will have an initial diameter corresponding to the diameter of the fiber, which can be up to 1/16" or 1587 μm (col. 4, lines 16-21). Furthermore, the beam will spread with distance. The applicant submits that this teaches away from the use of a light beam with a diameter more than 1000 times smaller.

Claim 6 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. No fibers or retainer are shown in Nguyen's Fig. 1. However, in Fig. 2 the optical fibers 34 are shown attached, at one end, to receivers (32) and transmitters (30). The other ends of the fibers are not retained and the fibers are not retained along their length. Motion of these fibers would limit the accuracy of edge detection. However, since Nguyen uses large diameter optical fibers (diameter up to 1/16") the fibers may be self-supporting. The thin fibers used in the present invention are retained at the ends where the light beam is transmitted and received, as shown in Figs. 1, 4 and 6. Claim 6 has been amended to clarify which parts of the first and second fibers are retained.

Claim 7 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. No retainers comprising a frame and block are shown in Nguyen's Fig. 1. Claim 7 depends from claim 6, which has been amended as described above.

Claim 8 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Firstly, Nguyen discloses a light source (12) but does not teach, suggest, disclose or render obvious that this is a laser light source. Laser light is fundamentally different from most other forms of light because it is coherent and monochromatic. Secondly, Nguyen does not teach, suggest, disclose or render obvious the use of a positioning stage. Nguyen's web (16) runs in direction A at a constant speed (col. 4, lines 1-3 and col. 5, lines 1-4). A positioning stage, as known in the art, does not move at a constant speed, has a finite range of motion and is designed to move an object to a position and hold it stationary in that position. This is not equivalent to a paper-making machine. Thirdly, Nguyen does not disclose the use of "a controller operably coupled to a positioning stage and responsive to the optical power signal, the controller being configure to cause the positioning stage to position the object a predetermined

position...". In Nguyen's Fig. 1, the signal processor (20) is coupled to the light sensor (14), a memory (22) and a display device (24). It is not coupled to, nor does it have control over, a positioning stage. Applicant submits that the positioning of a moving edge of an object is not equivalent to positioning the object itself at a predetermined location. In the former case the object is free to move in at least one direction (the direction A in Nguyen's system), in the latter case the position of the object is fixed. The examiner relies upon col. 3, lines 18-26 which only describe the monitoring of an edge, not control of its position.

Claim 9 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen's system is primarily a monitoring system rather than a control system. The detected gaps are logged in memory or displayed on a display device but no subsequent action to "cause the positioning stage to position the object at a predetermined position" is described.

Claim 10 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 10 depends from claim 8, which is discussed above.

Claim 11 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen uses a number of counters to measure the time between successive edges (col. 7 line 66 to col. 8 line 1). This time is proportional to the width of the gap, and since the web is moving at a constant speed, the time is proportional to the width of the gap. A gap is detected if the *time* (counter value) is within some range. The width of the gap cannot be adjusted to produce a counter value in this range. In contrast, in the present invention the edge of an object is positioned between two optical fibers such that the *optical power* is within a specified range. The examiner relies upon col. 8, lines 12-19, where an edge position is determined according to the order in which the

channels are activated (the present invention does not require multiple channel) and the value of counters (the present invention does not use counters).

Claim 12 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen uses a number of counters to measure the time between successive edges (col. 7 line 66 to col. 8 line 1). This time is proportional to the width of the gap, and since the web is moving at a constant speed, the time is proportional to the width of the gap. A gap is detected if the *time* (counter value) is within some range. The thresholds that determine this range depend upon the expected width of a gap and the speed of the web. In contrast to the present invention, the thresholds do not depend upon the maximum sensor power. The examiner relies upon col. 5, lines 45-49, which discusses a relationship between the number of channels triggered and the width of a gap. The present invention does not require the use of multiple channels.

Claim 13 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. The examiner relies on col. 4, lines 60-64, which does indicate which feature of the response is being calibrated. The applicant believes that Nguyen uses a calibration to determine the relationship between the time response of the sensor and the width of a gap (col. 5 lines 15-21). This calibration is used because the time response of sensors varies. No calibration of the amplitude response is disclosed.

Claim 14 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen measures the width C-D at regular intervals (i.e. once per revolution) *during calibration* only. In the present invention, the maximum power is remeasured *during operation*. Claim 14 has been amended to better clarify this distinction. The examiner relies upon col. 5, lines 34-

37, which describes the use of counter to measure a time interval. No amplitude measurement is taught, suggested or otherwise rendered obvious.

Claim 15 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 15 depends form claim 11 discussed above. Referring to Nguyen col. 5 lines 50-56, the present invention detects position rather than crack width and does not require the use of multiple sensor channels.

Claim 16 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Applicant submits that Nguyen does not teach the use of a positioning stage. Nguyen's web (16) runs in direction A at a *constant speed* (col. 4, lines 1-3 and col. 5, lines 1-4). A positioning stage, as known in the art, does not move a constant speed, has a finite range of motion and is designed to move an object to a position and hold it *stationary* in that position. This function is not performed by a paper-making machine, which produces continuous motion. The examiner relies upon col. 1, lines 13-18, which does not suggest, disclose or render obvious the use of a positioning stage.

Claim 17 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. As discussed above with reference to claim 16, applicant submits that Nguyen does not teach the use of a positioning stage. The examiner relies upon col. 1, lines 19-23, which does not suggest, disclose or render obvious the use of a positioning stage or a retainer.

Claim 27 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. As discussed above with reference to claim 16, applicant submits that Nguyen does not teach the use of an object positioning stage. Further, applicant submits that Nguyen does not teach the use of

a detector positioning stage. The examiner relies upon col. 6, lines 3-15, which describes the use of a fixed detector to detect an edge. No mechanism equivalent to a detector positioning stage is described, suggested or otherwise rendered obvious. As discussed above with reference to claim 1, Nguyen does not teach the use of optical fibers adapted to receive laser light.

Claim 28 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. As discussed above with reference to claim 8, applicant submits that Nguyen does not use a controller to position an object at a predetermined position since the object (the web) is in constant motion. Claim 28 has been amended to better clarify this distinction. The examiner relies upon col. 5, lines 4-11. This describes the detection of the *times* during which a slot in disc allows light to reach the detector. These times are measured and used to calibrate the time-response of the detection system. The position of slot is not controlled in response to the optical power. The position of the slot if not even defined since it is in constant motion.

Claim 29 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 29 depends from claim 27, which is discussed above.

Claim 30 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 30 depends from claim 27, which is discussed above.

Claim 31 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen uses a spinning disc for calibration (col. 4, lines 60-64). The positions of the slot edges in this disc are not

known as it spins. In contrast, the fiduciary in the present invention is at a known position relative to the detector.

Claim 32 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 32 depends from claim 27, which is discussed above.

Claim 33 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. While the use of *linear* servo-motors in positioning stages is known, it is common practice for a paper-making machine, such as that described by Nguyen, to use the *rotation* of rollers to move the web and the paper.

Claim 34 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 34 calls for "passing light from a laser source through a first optical fiber". Nguyen does not teach that the light source (12) is a *laser* light source. Further, claim 34 calls for "positioning the edge of the object *within* the light beam such that the optical power of the received light is greater than a lower threshold and less than an upper threshold" (emphasis added). Nguyen teaches the use of multiple sensor channels and determines the edge position by the number of sensors that are completely obscured. Hence a moving edge is positioned between adjacent light beams.

Claim 35 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen uses a number of counters to measure the time between successive edges (col. 7 line 66 to col. 8 line 1). This time is proportional to the width of the gap, and since the web is moving at a constant speed, the time is proportional to the width of the gap. A gap is detected if the *time* (counter value) is within some range. The thresholds that determine this

range depend upon the expected width of a gap and the speed of the web. In contrast to the present invention, the thresholds do not depend upon the maximum sensor power.

Claim 36 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen uses a calibration to determine the relationship between the time response of the sensor and the width of a gap (col. 4, lines 60-64 and col. 5 lines 15-21). This calibration is used because the time response of sensors varies. No calibration of the amplitude response is disclosed.

Claim 37 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Nguyen measures the width C-D at regular intervals (i.e. once per revolution) *during calibration* only. In the present invention, the maximum power is re-measured *during operation*. Claim 37 has been amended to better clarify this distinction.

Claim 38 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 38 depends from claim 34, which is discussed above.

Claim 39 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 39 depends from claim 34, which is discussed above.

Claim 40 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. The examiner relies upon col. 1, lines 19-23, in which Nguyen discusses the need to keep the web in motion. This motivates the use of an optical tear detector. However, there is no description of

positioning an object or moving a retainer for an optical fiber. In addition, col. 2, lines 44-48 indicates that the detector does not track lateral drifts in the web, implying that the detector and any retainer is stationary.

Claim 41 has been rejected under 35 USC §102 as being anticipated by Nguyen. Applicant respectfully traverses this rejection. Claim 41 depends from claim 34,